Technology Opportunity
Glenn Research Center • Cleveland • Ohio
Technology Transfer & Partnership Office

TOP3–00185

Optical Tweezers

Technology

The National Aeronautics and Space Administration (NASA) seeks to transfer technology for optical tweezers using radiation pressure.

Benefits

- Manufacture and characterization of nanoscale and microscale devices
- Uses noncontact and minimal contact probing of microscale and nanoscale matter to limit damage
- Manufacture, characterization, and imaging processes can be automated
- Multiple programmable optical traps
- Used in liquid, air, or vacuum environments
- Wavelength of light can be tailored to specific applications

Commercial Applications

- Nanoscale and microscale component assembly
- Nanoscale and microscale characterization
- Instrumentation manufacturing
- Biomedical applications
- Microscopy
- Polymer growth and characterization

Technology Description

Optical tweezers use the radiation pressure provided by tightly focused laser beams to move and manipulate matter on the micrometer scale and smaller. The optical tweezers provide a tool for nanoscale and microscale assembly of devices. Small particles held in the optical traps can be manipulated to the desired area and arrays of traps can be used to hold multiple parts. Arrays and single traps can also be automated with neural net (or fuzzy logic) control to recognize patterns and send traps to move particles to desired locations. Human control is also possible. Characterization of nanoscale and microscale matter is possible through investigation of light scattered from tool/material interface. Optical trapping for manufacture or characterization will be possible when the material under study is in liquid, air, or vacuum environments. This work is sponsored by the Low Emissions Alternative Power Project of the Vehicle Systems Program at the NASA Glenn Research Center.

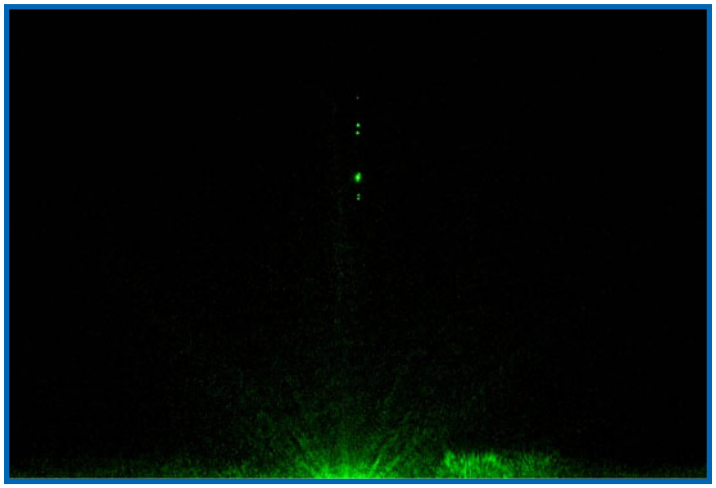

Figure 1.—Optically levitated 100-μm-diameter glass spheres.

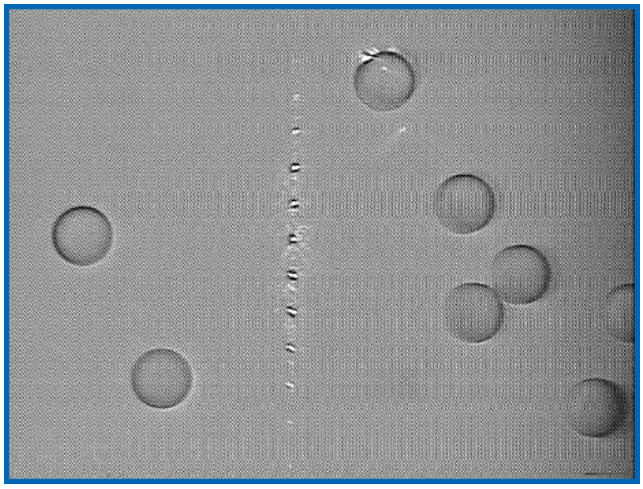

Figure 2.—Array of optical traps in liquid on microscope slide.

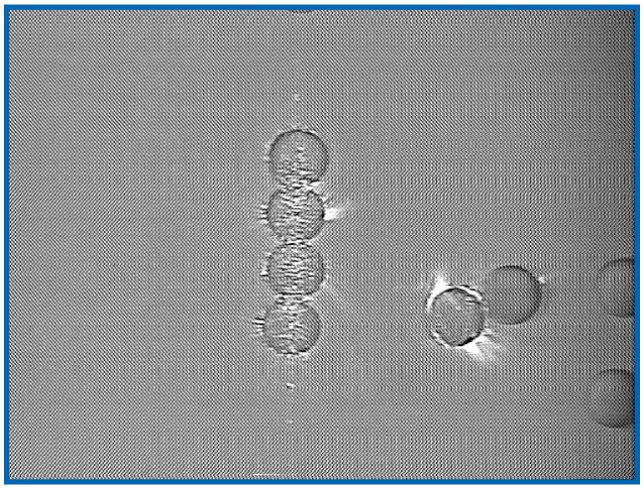

Figure 3.—13 μm polystyrene spheres moved to array of fixed optical traps from a movable optical trap.

Options for Commercialization

NASA Glenn Research Center is interested in working with industry and academia to further develop this instrumentation technology and identify new applications.

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References

NASA/TM—2002-211586
NASA/TM—2004-212889
NASA/CR—2002-211975
NASA/CR—2003-212726
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Key Words

Optical tweezers
Optical levitation
Optical trapping
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